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A

Topic Approval Seminar

On

“Adaptive Healthcare Solutions using Music Therapy”

Submitted in partial fulfillment of the requirement for the degree of PhD

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CERTIFICATE OF APPROVAL

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DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

Music therapy has a history of treating psychological, neurological, and physiological injuries of warfare. The music recommendation systems use content or collaborative-based music recommendation engines. Though, the music used is not only reliant on the music contents or historic preferences. This research aims to relieve stress and detect several emotions such as happiness, sadness, fear, anger, jealousy, etc. Music therapy improves the quality of life and it is suitable for adults, children, elder people with learning disabilities, mental health issues, and so on. An optimization algorithm is a procedure that will execute continuously by comparing many other solutions till an optimum or satisfactory solution is found. It may improve intellect and effort, enhance mental health, and increase the immune system and self-confidence. The proposed technique is evaluated and replicated with the existing music therapy present in the literature.

Chapter 1: Introduction

1. Introduction

Music is a part of all living beings, and it has a significant impact on their life. Humans listen to music to reduce stress in their day-to-day life. Classical music, at its core, provides positive feedback to the body, and as a result, it has been proven that classical music helps relieve stress. Music therapy is an emerging discipline that participates in medicine, psychology, music, and other fields. It is found that music has a positive effect on health. Music has been exposed to decrease human stress levels and has a significant positive effect on psychological state.

Music therapy for humans is a new phrase that was coined. This also helps to lessen their chronic conditions. Ragas, which are based on timings, are used in classical music. Ragas are combinations of notes on a certain scale. According to the Equal-Tempered scale, each scale in music has a total of 12 notes. Classical music in India also has 22 shrutis (tiny notes) that are more natural swaras. Furthermore, these natural swaras are far more effective than the Equal-Tempered scale.

Music is classified into types in variable ways, such as religious music and art music, or secular music and popular music. The creative nature of music means that these classifications are frequently subjective and provocative, and some types may overlap. Music also has an essential role in a person's emotions. As a result, it also aids us in determining a person's mood at any given time. A person's emotions may be detected and influenced by using the proper music with the right ragas. Music includes not just diverse pitches but also different tempos.

Each human body has a unique resonance frequency, which varies depending on the circumstances. To detect the issue, the real resonant frequency needs to be computed. To detect the frequency, certain types of biosensors are necessary. The concept is to make the person listen to classical music at the right time and in the correct frequency zone for improvement.

Deep learning is focused to make the machine have the similar capability to examine things as the human brain and to completely identify the unique details contained in data such as images, sounds, and text. The deep learning algorithm is a classy machine learning algorithm that obtains superior results in image recognition and language than some related machinery. In the customary music composition, the musician has established a particular semantic knowledge of music and combines both creative experience and emotion into making music [1]. Various emotions are detected while listening to a particular type of rhythm, so the original signal is recreated by the use of wavelet transform [2]. Compared to other non-pharmacological treatments, music therapy is fit for patients at all stages of dementia and has exposed better healing efficiency [3]. Music is one way of life, it provides a window to link with their emotions and musical cultures [4]. Music therapy is not an easy procedure for playing music. The music treatment has been categorized into short-term and long-term categories [5].

Telehealth is approximately defined as the to give health services where distance is a barrier to accessing health care [6]. Although, music emotion depends on various features. As a result, data dependability and estimate remain a substance of concern [7]. Music treatment is an interdisciplinary care model it uses is increasing in many other health settings [8]. However, the knowledge integration model cannot completely shows the user features using the auxiliary domain information [9]. In order to implement emotional expressions, even Google, Apple, Microsoft, and Facebook, are emerging technologies to remove or learn emotions or are taking over companies involved in this type of research [10]. The use of telehealth continues to enlarge, there comes a better necessity for creative arts therapists to improve familiarity and comfort with the distance delivery of their services [11]. Stress is a medium between the person and her/his environment and it can be assessed by much outside the obtainable resources [12]. Music cares also consume positive impacts on psychologists' pointers such as diastolic blood pressure, plasma norepinephrine levels, and blood cortisol levels [13]. Even using the models will not change the shared decision-making process, it may complement the data that patients receive from customary educational resources, hypothetically reducing decisional uncertainty for patients [14]. Therefore, an organized support vector machine model was built to define the video scenarios, such as gestures, color, and video content features [15].

The three types of music will be given during the treatment of patients, particularly natural sounds, music therapy, and sound generated in temples. By reviewing the music liked by the patient, the next session music will be recommended to the patient.

The problem statement is to make an efficient firmware system for the patients to overcome their stress or hypertension level, diabetes, and thyroids. Patients should take Music Therapy as a supplementary medicine to recover from chronic diseases. Based on a questionnaire, the proposed system needs to recommend classical music, natural sounds, and sounds generated in temples. The system needs to generate the test-case paper for the user. This system should also measure the data analysis by pre and post-feedback, through which it will predict the user's health improvement by using machine learning. The system should recommend classical music based on questionnaires and prerequisites of data mapping. The system should generate case papers of a user. Many people are not aware of Music Therapy. It helps to relax their minds and recover from chronic diseases, especially diabetes and hypertension. In this research, music technology is used to detect emotion recognition, decreased anxiety, increase self-expression, and so on. The detailed entire mechanism will be known after completing the implementation.

Chapter 2: Literature Review

2. Literature Review

A brief evaluation of some contributions to the existing literature is given below.

The emotion-based recommendation system [16] was used to enhance music recommendation engine performance through physiological sensor signals. In this system, only one sensor is used which affected management performance.

In the Emotion recognition method [17], the multimodal physiological system was used to produce healthcare achievement for emotional transformations. However, the amount of subjects utilized in the tests does not increase and the system provides a reason for poor robust outcomes.

Machine learning techniques were used to support music therapy after identifying various predictive factors of therapeutic success [18]. The research on the Intervention Countermeasures and Mental Health [19] decreases the research force on university teachers and afford them with comfortable teaching troposphere. Although, the students have a very poor base in the field of music, which carries them a substantial workforce. In the Neurologic music therapy method [20], the data has been collected to help control the suitability of interferences by patients.

The study is to explore and synthesize the story behind how music and its experience can impact our neural structures, which are implicated in emotional regulation[21]. Also, to consider the clinical implications of these findings to structure music stimuli to make the emotional regulation process easier.

Emotional regulation is a kind of process that will help the person to maintain or sustain a comfortable state of awakeness. It is done by modulating one or more aspects of emotion. The research aims to observe how music affects the neural structures involved in emotional regulation and to consider the clinical implications of such findings.

The review suggests that music experiences can affect emotional regulation. The results provide guidelines for music characteristics that may help during the emotion regulation process. The music is based on western culture. So a study was not defined for a different type of music.

Measurement tools: Magnetic Resonance Imaging, Positron Emission Tomography, electroencephalography, brain oxygen measurement tool called an OT system. The results indicate that certain music characteristics produce desired and undesired neural activation patterns involved in emotional regulation. The desired activation pattern occurs when a person is

listening to a preferred music taste. While undesired activation patterns occur when a person is introduced to unexpected musical events or complexity.

The second thing is to see the effect of music technology [22] and its potential contribution to health and wellness. Music is considered beneficial for physical and mental well-being. This article concluded that the art of music therapy, for improving one's health, is vast. However, there do exist some challenges to overcome. This article didn't cover how accessibility can be achieved while using music technology for improving one's well-being.

The classes of musical instruments are used to recognize emotion using deep learning algorithms[23]. Emotion recognition from the music clips of four instrument classes viz. string, percussion, woodwind, and brass is done which is classified into four emotions: happy, sad, neutral, and fear. Monophonic music clips are used to determine instrument emotion recognition. Parameters such as Mel frequency cepstral coefficients (MFCC), Chroma energy normalized statistics (CENS), Chroma short-time Fourier transform (STFT), etc, are identified and models are trained on these datasets. SVM and RNN are employed for this purpose. Monophonic music clips are considered for the dataset with only 4 emotion categories. Polyphonic music clips are not studied due to higher complexity because of the interference of multiple musical instruments. The deep learning recurrent neural network algorithm provides greater accuracy to figure out emotion from monophonic music clips as compared to the support vector machine.

The effect of music on the human brain[24] is recognized for its effect on attentiveness and concentration while reading. The concentration level of a user reading certain textual data is determined using MRI/CTS in the form of images. These images will further be processed using Digital Signal Processing in MATLAB. The user reads data in the presence and absence of music while the attentiveness and concentration of the user are compared for both situations. Verbal feedback is also considered. In the presence of music, attentiveness and concentration prove to be more as compared to that in the absence of music in some cases. Some cases concluded that attentiveness and concentration while reading was improved in the presence of music while some cases contradicted the former conclusion. This shows that a larger dataset is required for proper analysis of the effects of music while reading.

Young people have a belief that music will make them feel better[25]. The mood of young people gets easily changed by listening to various kinds of music. A piece of appropriate music

can alter the intentions, consequences, and mental health of young people. Listening to music can provide power to young people but might also have negative consequences. Certain music or songs might trigger their past memories or make them feel sadder. They might get depressed, frustrated, or angry which indicates that music can easily alter the mood of a person in a positive as well as negative context. Coded consequences and the number of people that contributed to the consequences categories is less due to which determining a consistent correlation couldn't be done. Grounded Theory Analysis with techniques of Theoretical Sampling & Axial Coding and Statistics are used.

The usage of music therapy is studied and examined in dementia [26] (a severe mental problem caused by any brain disease). The implementation and usage of music as a therapy is common on a daily life basis. But music therapy is not considered here on a serious level for a long-term basis. Thus, this study examined the frequency and acceptance of music therapy and the influence of high and low usage on behavioral and psychological symptoms.

Demonstrated results showed that long-term implementation usage of music within daily routines in nursing homes for people with disabilities should be strived for. To detect long-term effects in people with disabilities for the studied parameter for that eight-week intervention phase is not sufficient. The result of this study provides a shred of initial evidence that the usage and acceptance of personnel-guided music interventions such as music therapy in nursing homes are higher than other techniques such as videos/images with music or karaoke.

The further study aims to observe the practical effects of rhythmic auditory[27] on people. Many people bring out the regular beat of the music and align their movements according to the beat. To better illustrate this observation, Parkinson's disease is considered a model. Its focus is to observe the positive effects of rhythmic auditory cueing on the walking movements of people.

The rehabilitation of movement in Parkinson’s disease, with rhythmic auditory cueing, was used to show that music-based interventions can capitalize on individual differences in rhythmic abilities among patients.

The next is to apply music therapy to elderly people for diabetics [28]. It is followed by a lower extremity exercise regimen. Regular exercise promotes metabolism, improves insulin sensitivity, decreases blood sugar, and improves blood circulation. For elderly diabetics patients, due to the low rate of movement, exercise therapy often seems to be challenging. This study exposes such

patients to music therapy combined with a low extremity sports program. This helps in observing blood circulation and keeping patients consistent on a lower extremity exercise regimen.

This study reveals that for elderly diabetics patients, the combination of music and low extremity movements proves significant in improving blood circulation. Also, it improves lower limb vascular lesions in these patients.

After 3 months of intervention, there was a positive effect on the adherence to the lower extremity exercise for those who underwent music therapy as compared to those who did not.

The effect of music therapy is to identify and observe the physiological response of children[29]. These children belong to the preschool and school-age group that receives inhalation therapy. Asthma is a chronic disease that may occur in infants. Common symptoms include chronic cough, shortness of breath, and chest pain. Most of the children who are hospitalized due to asthma experience anxiety and mood swings. To relax these children and make them comfortable, music therapy is used.

Differences were observed in oxygen saturation after the inhalation therapy. The study was carried out on children having intermittent and mild levels of asthma. Also, it is carried on for only 44 children. This study observed a significant difference before and after inhalation therapy in the terms of average oxygen saturation; heart rate; respiratory rate.

The other study aims to assess the effects of a structured music therapy program on the clinical and social functioning indices of patients[30]. The study is carried out on those patients who are going through psychosis while being hospitalized in an emergency psychiatric ward.

This study is aimed to explore and evaluate the effectiveness of a structured music therapy program on patients who are suffering from a psychosis such as schizophrenia, or schizoaffective disorder. The psychosocial functioning of patients is measured through this study. This study included female patients only. Feedback was not collected after the patient's discharge. Thus, it is difficult to mention whether music therapy had a long-lasting effect.

Patients who experienced music therapy had better psychosocial functioning. Also, the depression and anxiety factor was reduced in patients experiencing music therapy as compared to those who didn't experience music therapy.

Another study aims to evaluate the effect of music therapy under general anesthesia on a patient's stress, pain, satisfaction, and awareness during the perioperative stage[31]. Generally, any

surgery and anesthesia put patients under an unpleasant experience. Hence, the chances of stress and anxiety increase, which can affect the desired therapeutic goal.

Music therapy is known for its effectiveness in several medical conditions. It is also beneficial in treating surgical patients. Music therapy proves to be an inexpensive and safe technique to improve patient satisfaction and overcome negative experiences related to perioperative stress. This included only the patients, which are operated on in visceral surgery. The choice of music can vary with every group of patients. Common music for treatment is not yet finalized.

One study used ragas (classical music) to reduce illness or disease using music therapy[32]. The system should identify the raga based on classification and also compare the performance of a various raga. The challenging issues here are which ragas to listen to, when to listen and how much time to listen. Feature extraction techniques from digital signal processing are adopted to address the particular raga with notes and swaras. Machine learning algorithms are used to classify the type of raga for a particular disease. The performance of the classification of ragas is done using various classifier algorithms.

Overall detection of ragas is considered. They are not actually based on accurate frequencies. Also, they are based on the equi-tempered scale and not natural swaras. As there is a variation of ragas with a very small difference in frequencies. Music Therapy here is considered as only listening to the music but the way of taking this therapy is not mentioned.

Different Machine Learning algorithms are used to detect ragas. Classification algorithms or classifiers are used to sort out the network traffic. The Baum-Welch learning algorithm is utilized for the identification of change in raga and initial state probability in HMM algorithm.

The effects of music are tested on low and medium-grade depression, and compare the results with psychotherapy[33]. For treating depression, there are three conventional treatments namely: psychotherapy, electroconvulsive, and pharmaceutical. As conventional treatments were not successful as expected, there's a need to adopt another method of treating depression. Music therapy, along with psychological support, has proven to reduce the low and medium grades of depression. Music has the power to treat several mental disorders. When compared to a group of people getting treated by music therapy with psychotherapy, the group showed the result of better recovery from depression. The group who was undergoing music therapy proved to have better improvement in their depression symptoms as compared to that of the psychotherapy group. This has a small sample size to compare results.

The effect of music therapy is determined for nursing students who are preparing for their clinical exams [34]. It is observed that students go through stress and anxiety during their exams. Thus, to reduce stress and anxiety, and to make students succeed in their clinical exams, music therapy methods are to be used and observed. For reducing anxiety levels and maintaining vital signs at a normal level, the power of music can be leveraged. During clinical exams, It is observed that students undergo anxiety and stress. To increase the signs of success in their exams, students have experimented with music therapy. Although music therapy puts a positive impact on the blood pressure of students, there is not much effect on their anxiety levels during an examination. According to students, though music therapy reduced their anxiety level in daily life, their anxiety level during their examination was not positively affected.

The study was carried out on nursing students. Thus, the sample was limited to certain kinds of students. The music therapy was administered for two weeks before the examination.

The effect of music therapy is studied on the patients who underwent orthopedic surgery [35] and observe the pain, anxiety, and the use of opioids on them. Generally, orthopedic surgery is considered one of the most painful surgeries. For this, music therapy can be considered to reduce pain and anxiety among patients who underwent this orthopedic surgery. This study concludes that music therapy helps postoperative patients to reduce their pain and anxiety.

This study failed to show the effect on the reduction of pain and anxiety when opioids are used among music group patients.

Another study is the relation between audio features, music emotions as well as individual factors [36]. Music emotion information is mostly used in the field of music information retrieval, music recommendation, and music therapy. Although computer scientists can extract musical emotions, they ignore the listener's individual differences. By applying machine learning models, this study aims to form relations among the audio features, individual factors, and music emotions. It is observed that audio features are used as the only input proves to be less effective to predict individual emotions.

Next, each feature has its own effects on the feeling models as compared to perception models. The results demonstrate that real-time individual features such as preference for target music and mechanism indices can improve the model's effectiveness. Stable individual features such as music experience, gender, and personality have no effect. The individual features, when

compared with the recognition models of perceived emotions, have significant effects on the recognition models.

The effect of music interventions is to study and analyze stress on a physiological and psychological level [37]. Stress is considered a major factor affecting psychological and physiological health. Music has been considered to normalize stress levels, anxiety levels, and even heart rate. It has been observed that music intervention has affected significantly psychological and physiological health, aiding in normalizing heart rate as compared to blood pressure and hormone levels. The effect of music intervention had a positive impact on stress reduction, restlessness, anxiety, and a state of worry.

The relationship between the duration or frequency of the music intervention and its effect on stress reduction is not clearly defined.

Another study is determining the effect of Creative Music Therapy on brain function and brain structure in preterm infants[38]. Preterm infants face cognitive and neurobehavioral problems which can be mitigated through non-pharmacological interventions such as Creative Music Therapy. The short-term and medium-term effects on the function and structural connectivity of the brain in preterm infants are studied. With only 40 infants being completely analyzed in the Randomized Controlled Trial it was found that Creative Music Therapy has a significant effect on promoting functional brain connectivity in preterm infants. The study could be more successful if there were no withdrawals of infants under study due to various reasons such as parental rejections, not participating in neuroimaging, etc. The sample size in such studies should be decent which can be improved by strengthening the engagement of parents. The number of infants assessed for eligibility was 293 out of which only 82 were included in the randomized controlled study. Moreover, this number too declined due to various reasons such as non-allocation, no MRI, and exclusion from analysis. Only 40 infants were completely analyzed which shows the number of infants understudied was very less.

Small sample size due to various factors such as parental rejection before inclusion and not showing up for tests after inclusion in trials.

With the help of machine learning the harmonic intervals and noise stimuli' effects on the heart, and responses are studied [39]. Effects of music with harmonic intervals and noise stimuli are studied on 26 subjects without vocational music training. The test was carried out under controlled conditions between 3 pm to 6 pm to reduce the effect of the circadian cycle on heart

function. 30 sounds were played in randomized order with 24 sounds with harmonic intervals in the octaves of 2 and 4 while 6 different noise sounds. Subjects were asked to register their perceptions after every sound on a scale of 1(worst) to 9(best). Each of the 30 sounds played had a different effect on the heart and varied responses. This was determined using ECG through which HRV was calculated and studied using two machine learning classification algorithms viz. k-Nearest Neighbor and Random Forest. Consonance quality also had an effect on the heart response which was an interesting result found in the study.

Matthews correlation coefficient (MCC) of 0.8 and more was observed throughout with Random Forest Classifier.

Another study is based on the evolution of chakras, the correlation between the evolution of chakras & embryogenesis [40], and the effects of chakras on the development of the child. Chakras are the energy hubs of the body located in the spinal cord and are related to specific endocrine organs. There is a vast source of information related to chakras but the evolution of chakras during embryogenesis is not known to much extent. The chakras are important for physical, mental, and spiritual comfort. The 8 chakras with their location in the body, the germ layer from which they are derived, the concerned physiological system, diseases due to blocked chakras, and their associated endocrine glands are studied and tabulated. The evolution of the chakras during embryogenesis is studied in detail along with the duration of evolution. Initially, all the chakras are fused as a single source of energy which separates and develops with the development of the fetus.

The association of chakras to various endocrine glands is studied but is yet to be empirically validated.

An unconventional model based on statistical physics concepts like Maxwell-Boltzmann (MB) and Bose-Einstein (BE) [41] is used in order to find parameters that can categorize Ragas based on their features. Various points can be concluded from the study as follows:

1. Significant results can be obtained even with a small corpus.
2. The parameter TMB is analogous to thermodynamics and demonstrates the nature of raga.
3. The parameter TBE can be used to demonstrate diversity in note variation.
4. Various other parameters such as z-value, and τ can be used to categorize music quantifiably.

The study indicates that MB and BE can be used to categorize music data. It can also be used for classification, categorization, and style identification of speech signals.

The dataset and Raga diversities understudy is small which when improved can give more parameters, stronger correlations, and finer categorization.

Another study focuses on machine learning approaches to create AI-based functional music that improves mental health [42].

A system for musical feature analysis based on MIDI and MFCC features has been used to train a supervised learning algorithm to determine the effect of emotional music on GSR and mental health. Elevated GSR was reported for negative music while less GSR was reported for calm pieces of music. Emotional responses too had the same elevation and depression for negative music and calm music respectively. The survey was done only on 53 candidates.

Automatic music analysis systems are developed. They are used for analyzing improvisations along with developing an interactive music system for people. They have limited motor abilities for facilitating clinical musical therapy work [43].

This study explores two main classes; automatic music analysis systems and interactive music systems. The latter class works in real-time and can be considered an example of Human-Computer Interaction. It shows how musical features of musical improvisations relate to perceived qualities. It enhances the knowledge of musical improvisation as a part of music therapy. It also provides insightful data on human-computer interaction in the musical domain. Musical features of musical improvisations that relate to perceived qualities were determined.

It explored various methods to develop software/tools for the analysis of improvisations without actually implementing them.

Another study is to determine the neurobiological effects on amino acids neurotransmitter levels, the excitatory/inhibitory balance, and the Glu-Gln cycle due to "Chinese Traditional Five-Elements Music Therapy" [44].

Male Wistar rats were randomly placed in experimental groups. Each group was given a different melodic music treatment for 2 hours per day for 28 consecutive days with mild sound pressure levels, between 50 and 60 dB. Different melodic music of the "Chinese Traditional Five-Elements Music Therapy" had different effects on the neurotransmitter levels, E/I balance as well as the Glu-Gln cycle of rats. The effects of music therapy on body weight, rat behavior, amino acid neurotransmitters, E/I levels, and Glu-Gln cycles were studied. Correlation between motor scores and neurotransmitter levels was also studied. Gong, Shang, Jue, and Zhi had the same outcomes as expected but Yu had inverted outcomes.

The study was done on rats which would be completely different from the case study on humans. One more study is based on the Linguistic Inquiry and Word Count based on lyric features and audio features on the perceived arousal and valence of music [45].

A study has been done on the association between LIWC-based lyric features and the perceived emotions of Chinese songs. Correlation analysis and computational modeling methods are used to find the relationship between lyric features and perceived emotions of music. Both audios, as well as lyric features, are considered since both are inseparable entities of music. Adding lyric features significantly improves the recognition model of perceived valence while it has no effect and is found to be useless in the case of the recognition model of perceived arousal. Audio features affect both the recognition model of perceived valence and arousal. The study was carried out on a Chinese dataset.

Chapter 3: Problem Statement

3. Problem Statement

Many people are not aware of Music Therapy. It helps to relax their minds and recover from chronic diseases, especially diabetes and hypertension, Thyroid.

The system should collect patient data related to diabetes, hypertension, and thyroid through questionnaires. The input is provided such as patient data, images, and text speeches for detecting emotions. The treatment is given to patients based on provided input, chakra genesis, ragas, and a recommendation engine. It should calculate enhancement in the treatment of patients through reducing medicine with the help of experts. It should validate, and compare results of natural sound, music therapy, and sound generated in temples.

Chapter 4: Research Objectives

4. Research Objectives

The major objectives developed in the proposed method are given as follows:

- Classification & Analysis of Music from the Perspective of Music Therapy.
- Collection of input from experts as well as patients in designing new technologies or clinical protocols.
- Developing a benchmark for emotional analysis of music.
- Build Music Recommendation System for Therapy.
- Develop music-based computational methods for health care.
- Identification of Devices, Technologies, and Interfaces for Supporting Music Therapy.
- Adapting tools for individual patients' needs (who have varying abilities across functional domains — cognitive, emotional, physical, etc.) that can produce useful analysis or real-time feedback of live musical interactions.

Chapter 5: Proposed System

5. Proposed System

In this proposed methodology, Music technology uses an optimization algorithm for emotion-aware healthcare systems to reduce human stress and work pressure, detect emotion regulation of a person, and so on. It is used to mind relax, improve brain attention and lift our mood. Music can also be utilized to help in insomnia patience, to induce and encourage deeper sleep. The overall flowchart of the proposed research is given in Figure 1.

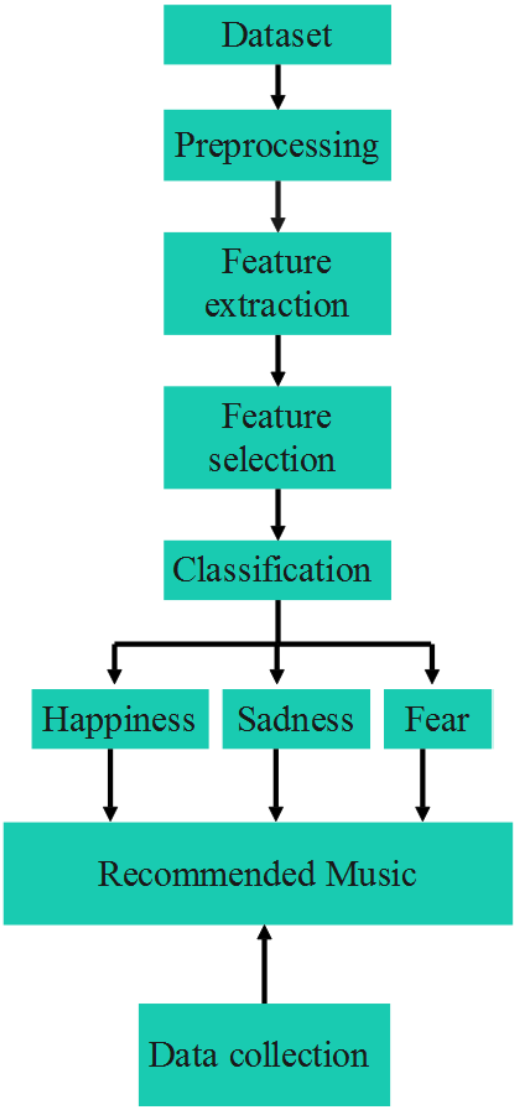

Figure 1. Flow chart of the proposed method

The most important steps of the proposed methodologies are defined as follows:

5.1: Dataset

At first this research takes datasets to healthcare by emerging musical technology. The proposed method performance is taken on the EmoHD dataset using supervised machine learning. (Emotion recognition in Health care Data). The EmoHD dataset is ready to train six various supervised machine learning models using a variety of feature engineering methods. Furthermore, forecasting the emotion from health-related content will support filtering out negative emotions to avoid therapeutic health issues either physical or mental. Moreover, the existence of negative emotions in a human eventually leads to dangerous stages such as suicide.

5.2: Preprocessing

After collecting data from the EmoHD dataset, obtain better results by doing some basic preprocessing steps including, Unwanted spaces, special characters, lowercase conversation, punctuation removal, etc,. The text cleaning steps are given as follows:

5.2.1. Lowercase conversation: It is the first of preprocessing. The purpose of this method is clear data by transforming the text into lowercase to avoid several reproductions of the same words. For example, 'Fear' and 'fear' must be considered as a single word but the case differences are calculated as different words. Thus, the lowercase conversation method is used to avoid such uncertainties.

5.2.2. Punctuation removal: afterward remove punctuation from the text, as it does not add any useful information while training the model. Eliminating all punctuation incidences from text data will assist the model to study functional features instead of non-functional instances.

5.2.3. Removal of stop words: Stop words need to be removed from the text data just because they don't have that much meaning in the machine learning model. For this purpose, use a predefined library of python, *i.e.,* nltk.corpus for English stop words.

5.2.4. Common words removal: Common words are removed from the written data due to high resemblance in the vocabulary. Overlapping in vocabulary affects the estimated scores during the training of machine learning classifiers. As these words are removed so in the classification of our text data they will not be of any use.

5.2.5. Rare word removal: Similarly, just remove the most mutual words and infrequently occurring words from the text. These words are very few or rare, hence, the association between them and other words is conquered by noise.

5.3: Feature extraction

It is the process in which we transfer the raw data into numerical features that can be processed while preserving the information in the original data set. A bag-of-words model, (BoW) is a method in which we extract the features from the text for use in modeling, such as with ML algorithms. The approach is very simple and flexible.

5.4: Feature selection

This technique is using the influence of optimization algorithms for selecting a subset of related features to get improved classification results. Furthermost, genetic algorithms use various controlling limits which need to be tuned for enhanced performance. Generally, there are maybe hundreds of popular optimization algorithms such as Dragonfly Algorithm (DA), Grasshopper Optimization Algorithm (GOA), Moth Flame Optimizer (MFO), Whale Optimization Algorithm (WOA), and so on. In this research, we will choose from any kind of optimization algorithm. An optimization algorithm is a procedure that is executive literately by comparing several solutions till an optimum or satisfactory solution is found.

5.5: Classification

The classification technique has been used to relieve stress and detect several emotions such as happiness, sadness, fear, anger, and so on. The MSVM (Multi-class Support Vector Machine) algorithm was assumed to present the connection-based training samples. The SVM is an established supervised learning technique utilized for regression and classification. Assumed a set of training examples, the SVM algorithm forms a classic model that finds the class of new unnoticed samples. Enhancing different classification algorithms for improving the MSVM classification of the recognition rate results. The MSVM classification technique improves the recognition rate and accuracy rate. This technique has reduced the noise level and enhanced the value of emotion recognition in the uploaded samples. The machine learning using the MSVM technique model has qualified and computed to identify emotional types such as sad, angry and happy, etc.

5.6: Recommended music:

Music therapy affords very limited movement the ability to create complex musical sounds, often with a few finger taps. Music is the main tool to effect change and report problems such as depression, trauma, self-expression, and anxiety. Music technology is functional, not playing music and singing songs to patients. Playing recommended music increases the body's production of an antibody immune system and enhances original killer cells. The recommended music plays only depend on the patient’s mindset. These cells boost the immune system’s efficiencies and attack invading viruses in the human body.

5.7: Data collection

The IADS-E (International Affective Digitized Sounds- Expended) is an extended version of the second version of IADS. The IADS offers normative ratings of feeling for a set of audio incentives for use in new inquiries of emotion and attention. It consists of commonly used natural sounds such as footsteps, typing, babies crying, sound effects, and background music. The original sounds in the extended version were collected from internet sources and sampled using software computer music is composed by a musician.

Chapter 6: Direct Observations

6. Direct Observations

Direct Observations

- The system should generate the patient's case paper, which is used to give the treatment to the patient.
- The system should measure the parameters such as Accuracy, Precision, Recall, and F1 Score.
- The system should validate and compare the results of natural sounds, music therapy, and sound generated in temples.
- The system should detect the emotional regulation of a patient.

Chapter 7: Indirect Observations

7. Indirect Observations

Indirect Observations

- The system should collect data from patients after asking questionaries based on diseases.
- After listening to the music, the patient will enter his/her review feedback about the liking of the specific music.

Chapter 8: Conclusion

8. Conclusion

Currently, music plays important role in our social world. For the mind and body, music creates harmony and a peaceful state. Many health conditions, including, pressure, stress, blood anxiety, and several other problems, indicate significant improvements. Using the concept of music technology, three types of music have been selected for treatment there are music therapy, sound generated in temples, and natural sounds. Deep learning is targeted to make the machine have the similar capability to examine things as the human brain and to completely identify the unique details contained in data such as images, sounds, and text. Nowadays, the work pressure in all walks of life is equivalent to that of physical activity work. To overcome these issues, this work focused to detect the emotional recognition of a person by using musical technology.

Chapter 9: References

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Topic Approval
Research and Recognition Committee for the Board of Studies in Computer Engineering

The concerned students, the concerned Research Supervisors and the Head / Principal / Director of the concerned Research Centre are hereby informed that the applications received from the students for approval of topic of the thesis for **Ph. D. (Science & Technology)** degree course in the subject of **Computer Engineering,** under Section 37(2)(b)(i), were placed before the **Research and Recognition Committee** for the **Board of Studies** in **Computer Engineering,** at its meeting held on **22nd July, 2022** for its consideration, when the Committee **approved** the outline of the topics submitted by the concerned students.

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Further, the aforesaid students are hereby allowed to register themselves for **Ph. D. (Science & Technology) Degree** course in the subject of **Computer Engineering**, subject to fulfill the UGC conditions on minimum standard and procedure for award of Ph.D. Degree

The registrations of the concerned students are subject to the intake capacity of the Department/College/Institute.

Please note that the students from other than University of Mumbai are required to submit a **Provisional Statement of Eligibility** issued by this University before their admission to the said course in the Department/College/Institution.

Umesh Avhad
Assistant Registrar
RAPC

To,

The concerned students, the concerned Research Supervisors and the Head / Principal / Director of the concerned Research Center

Copy to the Deputy Registrar, Eligibility and Migration Certificate Section, Dr. Babasaheb Ambedkar Bhavan, Vidyanagari, Santacruz (E), **Mumbai -400 098** forwarded for information.